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Drift Motions of Small Lattice Gases System and Toy Model of Brownian Machines.

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Abstract
短いサーキット状の簡単な格子ガス系が示す、ある非自明なドリフト運動について議論する。具体的には、外力の向きを固定したまま大きさを変えることで起こる、系のドリフト方向の (部分的な) 反転について述べる。またこの挙動とバクテリアの鞭毛回転モーター等の運動との類似性に触れ、生体分子機械の動作の理解に向けた展望を考える。

Drift motions in a non-equilibrium small lattice gases system which consists of two particles interacting repulsively in the potential are investigated. We found that the present system realizes the following two types of drift motions and the transition between them under the driving force working on one of particles; I) Forward drift: Both particles drift in the same direction as the force direction if the driving force is large. II) Backward drift: While the directly driven particle drifts in the force direction, the other particle drifts in the opposite direction if the driving force is given as the certain strength (not so large). By the analysis through the transition diagrams, we explain the mechanisms of this inversion of the drift directions.

Similar motions to our obtained results, the forward drift and the backward drift, have been observed as the motions of the agellar motor in Bacteria. The agellar motor is a rotational motor in which a rotor realizes the steady rotations due to the ows of protons driven by the electrochemical potential gradient across the membrane. Here, depending on the environment around the Bacteria, this rotor realizes both directional rotations, the clockwise and counter-clockwise rotations, by the unique directional ows of the protons. We expect that our results give important hints to nd out the possible mechanism for such performance of this motor.